25 Emergency Video-Assisted Thoracoscopy in the Elderly

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25.1 Introduction

Video-assisted thoracoscopic surgery (VATS), like any other minimal access surgery, offers considerable benefits to patients compared to traditional thoracic procedures: it positively influences postoperative pain, morbidity, and mortality. Furthermore, it has been largely demonstrated that VATS can reduce hospital stay when compared to thoracotomy [1]. For these reasons, in the last decade, VATS has become a popular surgical approach, and nowadays, it is used to diagnose and treat a variety of conditions within the chest cavity [2]. The application of VATS in acute settings was originally reported in a series evaluating diaphragmatic injuries [3]. Over the last years, in addition to detecting diaphragmatic injuries, numerous other indications have evolved as a result of increasing familiarity and acceptance of the VATS technique worldwide [4–6]. Indications for subacute thoracoscopy following trauma include empyema, treatment of thoracic duct injury, and removal of symptomatic foreign bodies. Furthermore, VATS has been used for chest trauma in hemodynamically stable patients who have an indication for urgent thoracic exploration within 24 h following presentation [7, 8]. The surgical treatment of elderly patients with chest injuries is a great challenge: elderly patients have up to four-fold greater morbidity and mortality rate compared with younger patients [9–11]. Because of increased underlying comorbidities and decreased physiologic reserve in the geriatric population, the severely injured elderly patient requires intensive monitoring, aggressive management, and comprehensive care [12]. For these reasons, VATS is increasingly used in the treatment of thoracic injuries in elderly patients too [13, 14].

25.2 Indications for Thoracoscopy

Although the majority of hemodynamically stable patients with thoracic injuries can initially be managed with tube thoracostomy and close observation, some patients may progress to develop acute and chronic complications requiring operative therapy. Thoracoscopy has a role in both diagnosis and treatment of chest injuries. Hemodynamic stability is an important prerequisite, since thoracoscopy is not an approach to be used in the initial assessment of hemodynamically unstable injured patients. In patients

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experiencing thoracic injury with hypovolemic shock, emergency thoracotomy remains the most appropriate option. Further, thoracoscopy is contraindicated in patients unable to tolerate lung deflation with single-lung ventilation [14].

25.3 Hemothorax

The most common causes of hemothorax can be divided into traumatic, iatrogenic, and nontraumatic causes as shown in Table 25.1.

The majority (85%) of patients with hemothorax are managed by tube thoracostomy. Guidelines recommend referral for surgery for acute blood loss over 1500 mL or recorded ongoing drainage of more than 200–400 mL over 2–4 h [15]. Hemothorax typically progresses in three manners: complete spontaneous reabsorption of blood within several weeks, progression to fibrothorax, or infection with empyema formation. In the initial management of hemothorax, CT scan is an important tool to detect the bleeding site and to identify other sources of hemorrhage than the intercostal arteries (ICAs). In case of active bleeding from ICAs transcatheter arterial embolization (TAE) is a safe and effective measure to arrest bleeding in hemodynamically stable patients [16].

The majority of hemothoraces following blunt trauma are easily treated by drainage and re-expansion of the lung. If bleeding continues, underlying factors, such as coagulopathy, acidosis, and hypothermia should all be sought and addressed. Particular attention should be paid to the elderly on various forms of anticoagulation. Normally, bloody effusions are entirely resorbed after 4–6 weeks without causing infection. However, some patients may experience retained hemothorax because of malposition or poor drainage of chest tubes. Retained hemothorax is defined as residual clots at least 500 mL large, or in which at least one-third of the blood in the pleural space cannot be drained by a chest tube after 72 h of initial treatment revealed by a computed tomography (CT) scan [17, 18]. In the past, the primary method for treating retained hemothorax was to perform an additional tube thoracostomy or exploratory thoracotomy.

Jones et al. in 1981 first described the role of VATS in the initial management of patients with hemothorax. They found that thoracotomy could be avoided in the majority of stable patients with high chest tube output and bleeding was stopped in most cases with electrocautery [19].

For patients undergoing VATS surgery, single-lung ventilation is ideal, allowing adequate visualization. If the patient is unable to tolerate this for underlying lung pathology or significant contusion, double-lung ventilation with intermittent apnea is an option. Patients should be placed in the lateral decubitus position with flexing of the table to allow widening of the intercostal spaces.

The initial incision for the camera placement is in the sixth or seventh space or at the site of the tube thoracostomy. The thoracic cavity is entered under vision. The placement of additional ports may be determined after the initial inspection with the thoracoscope, with current evidence, single or multiport approaches are equally acceptable. After insertion of the thoracoscope, the adhesions should be released by blunt digital dissection or sharp endoscopic

Table 25.1 Most frequent causes of hemothorax

Traumatic	Iatrogenic	Non-traumatic
Penetrating or lacerating chest trauma (lung blood vessels, chest wall, diaphragm, pleural adhesions, mediastinum, large vessels, abdomen)	Cardiac or lung surgery Pleural techniques (thoracentesis, pleural biopsy, drains) Insertion of catheter in the subclavian vein Percutaneous lung biopsy	Neoplasias (primary or metastatic) Pulmonary embolism Catamenial hemothorax Anticoagulant treatment Hematological diseases (hemophilia, thrombocytopenia) Intrapleural fibrinolytics Aorta dissection or rupture

electrocoagulated dissection. Full-lung collapse is crucial for inspecting the entire pleural cavity. Blood and clots are removed by using a standard suction instrument or a suction–irrigator system. A sample of fluid is routinely collected for microbiological assessment. In patients with organized thoracic collections, carefully dissecting and peeling away the outer layer with sponge sticks and ring forceps typically enables the outer layer to be removed from the visceral and parietal pleura, thus completely releasing the trapped lung. Following adequate drainage and washout of the hemithorax, a chest drain should be placed prior to closure. It is crucial to ensure that the lung fully expands to occupy the space. If there is residual space, blood can recollect and lead to postoperative complications.

There is evidence in the literature that VATS, in well-selected patients, is superior to tube thoracostomy and leads to decreased post-traumatic infection length of ventilatory dependency and overall hospital stay [20]. Increased age is associated with a decreased respiratory function. As chest wall compliance decreases secondary to structural changes, such as vertebral collapse and kyphosis, inspiratory capacity decreases. Furthermore, it needs to be remembered that injured lungs have a compromised compliance and the presence of low suction might be advisable to promote drainage of pleural fluid.

25.4 Diaphragmatic Injury

Diaphragmatic injuries account for 3% of all trauma cases and up to 8% of trauma surgical explorations. It may be due to both a severe blunt trauma, from motor vehicle accidents, and penetrating trauma, from knife or gunshot wounds. Diaphragmatic hernias are more common in the elderly population and they have higher associated mortality than younger age groups [21]. The mechanism of diaphragmatic injury is often high impact injuries which lead to a sudden increase in intra-abdominal pressure causing rupture. The right diaphragm is protected by the liver; hence, 80% of ruptures occur on the left.

Diagnosing a diaphragmatic rupture after trauma is a challenge for both emergency radiologists and surgeons. The initial radiograph can be diagnostic, however, in one series of elderly patients with traumatic hernias, 50% of initial radiographs were normal. A normal admission radiograph can result in delays in diagnosis and delay to operative repair which increases rates of surgical complications such as time of ventilatory support and death [22]. Even CT scanning can be non-definitive, it has a low sensitivity (53–74%) [23]. Atelectasis, pulmonary contusions, hemothorax, and intra-abdominal pathology can mask diaphragmatic injury.

Two principles must be observed when repairing acute traumatic diaphragmatic hernias: complete reduction of the herniated organs back into the abdomen and watertight closure of the diaphragm to avoid recurrence. The role of VATS in this situation is invaluable as it has a 100% sensitivity and allows for repair at the same time [24]. Thoracoscopy provides excellent visualization of the posterior recesses of the thoracic cavity, areas not often seen well with the laparoscope. The patient should be placed into the Trendelenburg position to facilitate adequate visualization of the diaphragm. Nasogastric tube placement is important to deflate the stomach and can facilitate reduction of any herniation. Simple interrupted sutures should be enough to repair most of the acute defects [25] and mesh repairs should be reserved for chronic or large defects.

25.5 Esophageal Perforation

Esophageal perforation is a rare condition occurring in 3 out of 100,000 people in the United States. The advances in diagnostic and therapeutic endoscopic interventions have led to iatrogenic perforation as the most common etiology (Table 25.2) [26].

Iatrogenic perforation is common in the hypopharynx or the distal esophagus while spontaneous rupture may occur in the posterolateral wall of the esophagus just above its diaphragmatic hiatus. Esophageal perforations can present in different ways depending on several factors including the etiology of the perforation, the location of

Table 25.2 Causes of esophageal perforation

Etiology	Incidence (%)
Iatrogenic	59
Spontaneous	15
Foreign body ingestion	12
Trauma	9
Operative injury	2
Tumor	1
Other causes	2

the perforation (cervical, intrathoracic, or intra-abdominal), the severity of contamination, injury of nearby mediastinal structures (i.e., trachea or pericardium), and the time elapsed from the perforation until treatment. Common symptoms include chest pain, dysphagia, dyspnea, subcutaneous emphysema, epigastric pain, fever, tachycardia, and tachypnea. Early diagnosis is very important because it significantly decreases morbidity and mortality [27]. Computed tomography (CT scan) of the chest and abdomen should be performed when esophageal perforation is suspected. It has the advantage of showing intrathoracic or intra-abdominal collections that require percutaneous or surgical drainage. The principles of management in esophageal perforation are to eliminate the focus of infection and inflammation, prevent further contamination of the mediastinum with adequate drainage and antibiotics, restore alimentary tract continuity and establish nutritional support [28]. For those who receive surgical intervention, within the first 24 h, the published mortality is 13% [29]. Traditionally, upper and middle third perforations are approached via thoracotomy with primary closure, esophagectomy, use of esophageal T-tube, exclusion-diversion, and mediastinal drainage. However, few studies have demonstrated the efficacy of VATS approach in esophageal perforations but further studies are needed to clarify its role in primary repair [30]. In selected cases of esophageal perforation, thoracoscopy can be applied by using the same surgical principles as in the open thoracotomy approach. Advantages of the video-thoracoscopic approach are the excellent view of the whole thoracic cavity and adequate debridement and proper drainage of all pleural cavity areas. Either primary closure or an esophageal T-tube can be used to close the esophageal leak. By avoiding a major thoracotomy, the patient benefits from less postoperative pain, a decrease in wound-related complications, and a faster postoperative recovery. Over the last decade, stent grafting of esophageal perforations has been increasingly adopted with promising results. VATS debridement and drainage can be used in combination with stent positioning allowing for control of the septic focus [31]. VATS in association with endoscopic techniques may be particularly suited for the elderly patient population, as the significant morbidity of a thoracotomy or laparotomy may be avoided [32].

25.6 Descending Necrotizing Mediastinitis

Descending necrotizing mediastinitis (DNM) is a severe complication of infection originating from the neck, most commonly an oropharyngeal or odontogenic focus, which spreads in the cervical fascial spaces and descends into the mediastinum. Early diagnosis is essential because DNM can rapidly progress to septic shock and organ failure. At present, the cervicothoracic CT scan is the gold standard for diagnosis. Odontogenic sources, tonsillar and pharyngeal abscesses, sialadenitis, injury by a foreign body, or catheterization are common origins of DNM. Elderly patients are immunocompromised with comorbidities, such as diabetes mellitus, malnutrition, renal failure, liver cirrhosis, and underlying malignancy. This alone may significantly compromise patient outcomes and be a predicting factor for mediastinal spreading.

Early aggressive intervention and medical optimization can stop the progression of descending mediastinitis and to septic shock, drastically improving survival. Transcervical drainage alone may be effective for localized DNM in the upper mediastinum, whereas combined cervical drainage and mediastinum drainage may provide adequate drainage for DNM extending to the lower anterior mediastinum. In case of DNM extent into the anterior and lower posterior mediastinum, the optimal treatment should include radical surgical debridement of affected tissue through an open thoracic approach [33, 34]. However, these invasive methods are high-risk approaches for elderly and critically ill patients with overwhelming sepsis and may lead to unfavorable outcomes with complications. In 2004, Isowa et al. first reported the successful management of descending necrotizing mediastinitis patients with VATS [35]. At around that time, more and more authors advocated VATS as one of the treatments for DNM and emphasized the excellent visualization of the entire thoracic cavity, the lower degree of invasiveness, and favorable outcome [36, 37]. Patients are positioned with full lateral decubitus and under direct vision of thoracoscope, the mediastinal pleura around all abscess pockets is opened and the pus drained through it. In all patients, chest tubes are positioned in the mediastinum through the opening of mediastinal pleura for drainage of mediastinal pus.

Five Things You Should Know About Emergency Video-Assisted Thoracoscopy in the Elderly

- VATS have a role in both diagnosis and treatment of chest injuries in hemodynamically stable patients.
- Chest trauma is the most common cause of hemothorax, the majority of hemothoraces are managed by tube thoracostomy.
- VATS, in well-selected patients, is superior to tube thoracostomy in decreased post-traumatic infection, length of ventilatory dependency, and overall hospital stay.
- The role of VATS in diaphragmatic injuries is invaluable as it has a high sensitivity for diagnosis and allows for repair at the same time.
- VATS may be particularly suited for the elderly patient population, as the significant morbidity of a thoracotomy or laparotomy may be avoided.

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